The Refrigeration Service Engineer

VOL. 10 NO. 9 ★ ★ ★ SEPTEMBER . 1942

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Published in the Interest of Equipment Conservation through More Effective Servicing

Location and Adjustment of Expansion Valve

EXPANSION VALVE IN WRONG LOCATION. **If power element on valve becomes colder than feeler bulb it will cause valve to close and starve evaporator. Don't locate the valve directly under the coil or where it will be cooled too much. Capillary tube must also be clear of cold surfaces.**

Detection:

A. Warm power element and capillary tube with your hand. If power element is too cold this will temporarily correct trouble. Then rearrange

thermostatic expansion valve is probably the most misunderstood part of the re-

starves the evaporator. Expansion valves seldom change their adjustment of their own accord. When a system which has been operating satisfactorily suddenly changes, the chances are that expansion valve adjustment has not changed but something else has gone wrong. Always check everything else before attempting to adjust the valve. If a small turn does no good it is good assurance that some

Detroit valves are adjusted at the factory to keep the coil completely refrigerated. However, if it is de-

tube with your hand. If power element is too cold this will temporarily correct trouble. Then rearrange

thermostatic expansion valve is probably the most misunderstood part of the refrigerating system. As a matter of fact, its function is extremely simple. *It keeps the coil completely refrigerated.* Always keep that in mind when servicing a system. Adjustment of the valve merely floods or

to adjust the valve. If a small turn does no good it is good assurance that some

Detroit valves are adjusted at the factory to keep the coil completely refrigerated. However, if it is desired to adjust the valve, proceed as follows: Open valve so as to slightly flood the evaporator; then turn the adjustment back until the evaporator is completely refrigerated without any flooding over into suction line.

A complete Service Analyzer, giving many helpful hints, will be sent upon request.

SYMPTOMS					PROBABLE CAUSE
Condition of Job	*Evaporator Condition*	*Running Time*	*Suction Pressure*	*Suction Line Temperature*	
Warm	Warm	Won't Start	Low	Warm	Expansion valve badly out of adjustment
Warm or Normal	Starved or Partly Refrig.	Short Cycle	Low	Warm	Expansion valve out of adjustment
Normal or Cold	Flooded	Too Long	Normal or High	Flooded	Expansion valve out of adjustment

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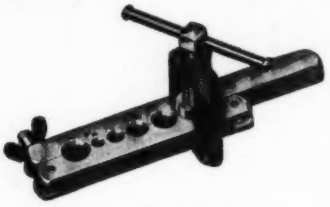
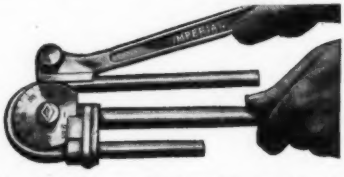
No. 212-F similar in construction to No. 174-F for $\frac{1}{16}$" to and including 1⅛" O.D. tubing.



No. 95-F Imperial Flaring Tool for ¼", $\frac{5}{16}$", ⅜", ½" and ⅝" O.D. tubing. The Imperial Flaring Tool flares copper, brass, aluminum or plastic tubing to make up S.A.E. joints without cracking or splitting. If care is taken fair results can also be obtained in flaring Bundy steel tubing. Also other sizes for larger tubing.



No. 364-F Imperial Hand Tube Bender in seven sizes for $\frac{3}{16}$", ¼", $\frac{5}{16}$", ⅜", ½", ⅝" and ¾" O.D. Tubing. This smoothly operating bender forms neat, accurate bends to a short radius in a minimum of time without marring or deforming the tubing. It is a one-piece, open-side bender which slips over the tubing quickly without making adjustments and which can be used to make bends at the end or at any part of the tubing. This feature makes it especially handy in inaccessible places where tubing has been partially connected.

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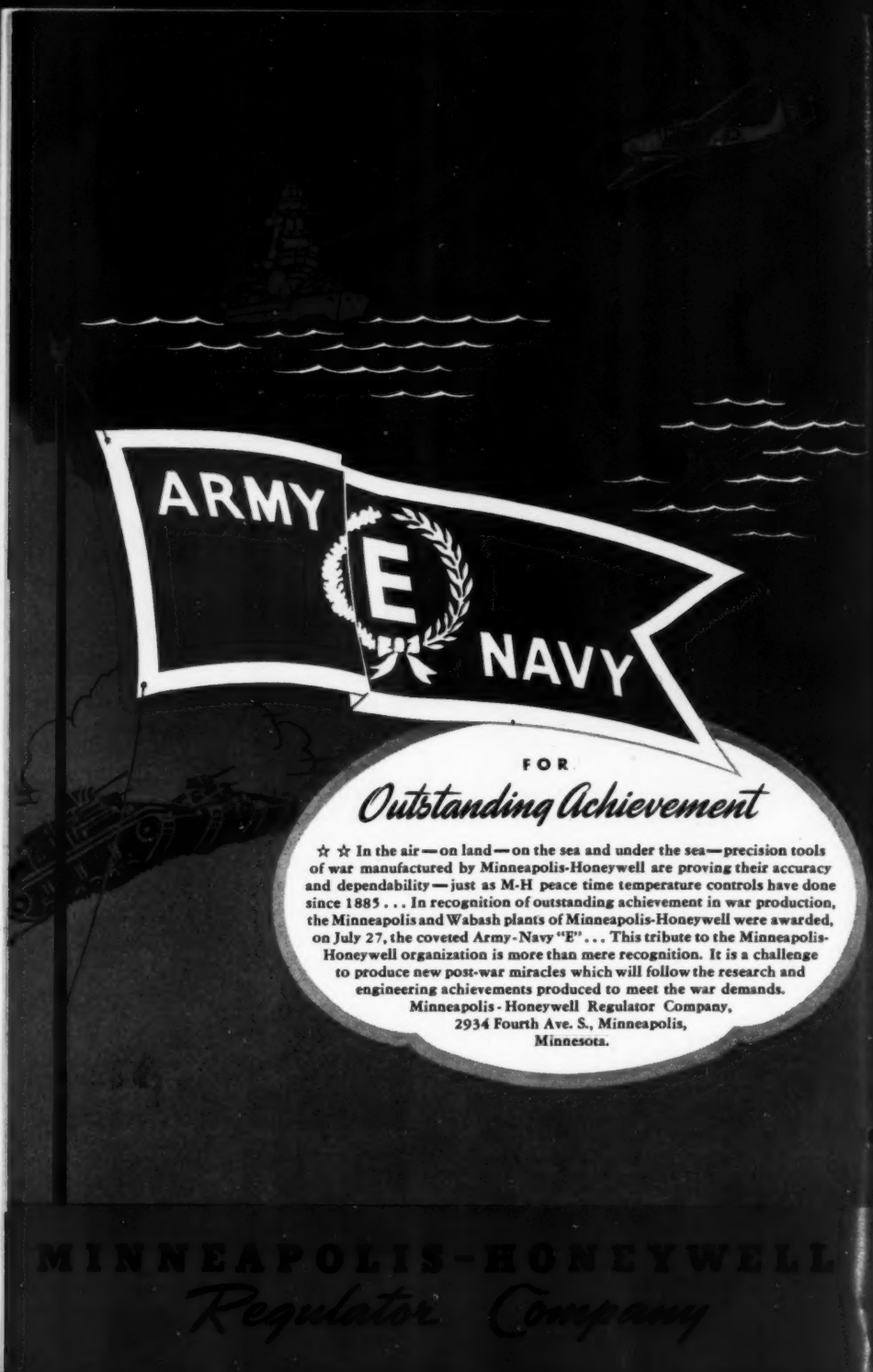

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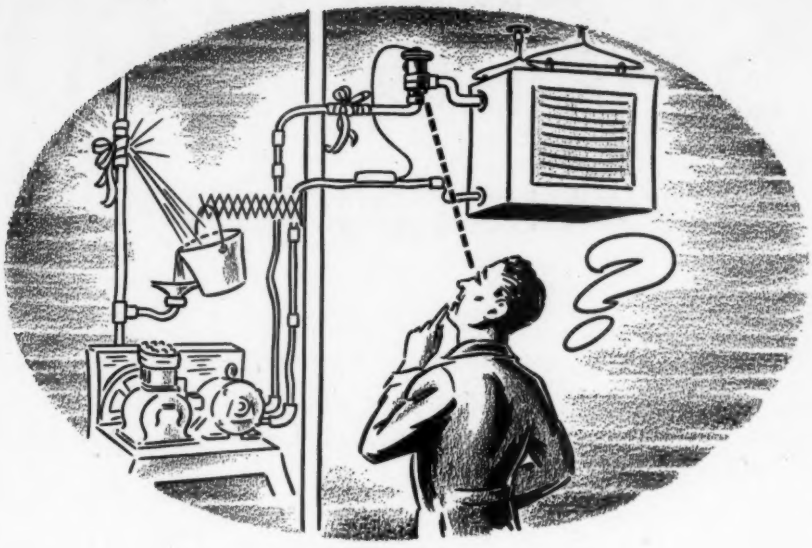

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Regardless of Restrictions, Shortages, Hardships

The maintenance, in working order, of our Nation's existing refrigeration equipment is tremendously vital today. On this depends America's health and food supply. Under present conditions of material shortages, service men and dealers are performing "near-miracles" in keeping equipment running. Regardless of handicaps, we've got to "Keep 'Em Refrigeratin' " for the duration of the War.

The products of the air conditioning and refrigeration industry are widely used by the armed forces and in the production of war materials. We are a metal working industry—but so is the making of war materials.

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The Refrigeration Service Engineer

Vol. 10 No. 9

September, 1942

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ
REFRIGERATION SERVICE ENGINEERS SOCIETY

Cover

Staff Sergeant Elton W. Mattson, one of the non-commissioned instructors in the Refrigeration School at Camp Lee, is describing the operation of the refrigerating equipment of a knockdown type walk-in cold storage room. This apparatus is similar to that used in the mobile refrigeration trailer unit. It is widely used in semi-permanent Army installations, such as temporary air fields.

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The Refrigeration Service Engineer

Vol. 10, No. 9 CHICAGO, SEPTEMBER, 1942 $2.00 Per Annum

Banana Storage One of the Most Difficult Problems

By S. C. MONCHER

THE physical and chemical properties of bananas are so different from those of other common fruits as to make the problem of banana storage a subject for study in itself. Not only are proper conditions of temperature and humidity necessary for the effective preservation of bananas, but they are also important in the process of the ripening of the fruit. Storage is usually carried on at 55° and 75% relative humidity, while ripening is effected as the temperature is gradually reduced from 70° to 62° during a period of 4 to 6 days, humidity being maintained at 85-90%. The need for so flexible a system makes the installation of banana storage equipment as complex a problem as the refrigerating engineer is called upon to face, and results in many modifications to the ordinary refrigeration system.

Banana distributors receive their product in a green state; proceed to ripen it, and then store it under refrigeration until sold. The ripening and ensuing storage are carried out in the same room, wherefore equipment must be installed which will maintain temperatures from 55° to 70°, with corresponding humidities of 75-90%. In most sections of the world this requires the use of heating, humidifying and dehumidifying equipment, as well as cooling equipment. Humidification is usually accomplished by the use of spray nozzles, while dehumidification after ripening can often be accomplished by ventilation with outside air. This latter, of course, would not hold true of certain localities during the summer or rainy season.

It is obvious that in order to insure a constant supply of ripe fruit, every distributor will need several refrigerators; some to contain the fruit being ripened, and others to hold the ripened fruit. The installation which we shall consider consists of five adjacent refrigerators each large enough to accommodate a carload of bananas (21,000 lbs.). See Fig. 1.

SURVEY SHEET

	Rooms 1 & 5	Rooms 2, 3 & 4
Outside Dimensions	32'x12'x8'	32'x12'x8'
No. of Common walls	1	2
Insulation	3" corkboard	3" corkboard
Maximum Ambient Temperature	85°	85°

Minimum Ambient Temperature	40°	40°
Minimum Refrigerator Temperature	55°	55°
Maximum Refrigerator Temperature	70°	70°
Product load per refrigerator	21,000 lbs. to be reduced in temperature at the rate of 1° per hour	
Respiration load	.5 B.t.u. per hour at 70° .3 B.t.u. per hour at 55°	
Electric Motors	.5 hp. per refrigerator	

Load Calculations

Inasmuch as the adjacent refrigerator may or may not be in use at any given time, it is advisable to ignore the common wall for purposes of load calculation, and figure the same load for all the refrigerators.

Total outside surface of each room = 1472 sq. ft.

Cubical content = 2390 cu. ft.

A. Heat gain of rooms during ripening period

	B.t.u. per hr. for each room
Insulation loss = 1472x.09x15* =	1980
Usage loss based on ½ air change per hour = 2390x.8x.5 =	950
Product load = 21,000x.9x1 =	18900
Respiration load = 21000x.5 =	10500
Motor load = 2000 x.5 =	1000
Total load =	33330

B. Heat gain of rooms during holding period

	B.t.u. per hr. for each room
Insulation loss = 1472x.09x80 =	8960
Usage loss based on one air change per hour 2390x1.4 =	3340
Respiration load = 21000x.3 =	6300
Motor load = 2000x.5 =	1000
Total load =	14600

* Inasmuch as the respiration rate falls with the temperature, it will more than offset the use in insulation loss, and a temperature difference of 15° between refrigerator and outside air may safely be used in determining the peak load.

Equipment Selection

It has been pointed out that at any given time some of the rooms will be in use for ripening, while others will be vacant or in use for holding the ripened product. For the five refrigerators discussed above, the maximum load may be taken as occurring when three of the rooms are being used to ripen the fruit, and two rooms to hold the fruit. This gives a total operating load on which to base equipment selection as follows:

3x33330 = 99990 B.t.u. per hr.
2x14600 = 29200

Total = 129190 B.t.u. per hr. = 10.8 tons

The highside equipment, therefore, will have to be able to produce a maximum capacity of 10.8 tons, although during a great part of the time when not all the refrigerators are in use a capacity from 5 tons upward will suffice. A system of this type is best served by two individual compressors, so arranged that the second one cuts in only when the first fails to do the work required. How this is accomplished will be described under equipment installation.

In order to maintain the high humidities required in banana storage, it is necessary to operate with a refrigerant temperature no lower than 40°, corresponding to an evaporator temperature of 37 pounds Freon-12. Where two condensing units are used, each will have to have a capacity of 5.4 tons at 33 pounds F-12 (allowing for nominal pressure drop), or in terms of standard highside units—two 5 hp. condensing units. These units may be arranged either with a common condenser and receiver, or individual condensers and receivers.

For lowside equipment, forced air units are by far the most practical, the floor type unit as illustrated in Fig. 2 being particularly suitable. Each unit would require a capacity of 33330 B.t.u. per hr. (appr. 3 tons) at an average temperature difference of 20 degrees between refrigerant and air. In order to insure even and constant air distribution to all sections of the refrigerator, the use of a duct along the ceiling through the center of the room is highly recommended. (See Fig. 1) This duct will handle the air leaving the unit, distributing it through grilles spaced about every seven feet. The return air to the unit enters directly at the base of the unit, at which point is also attached a small duct leading from the ventilation door. (See Figs. 1 and

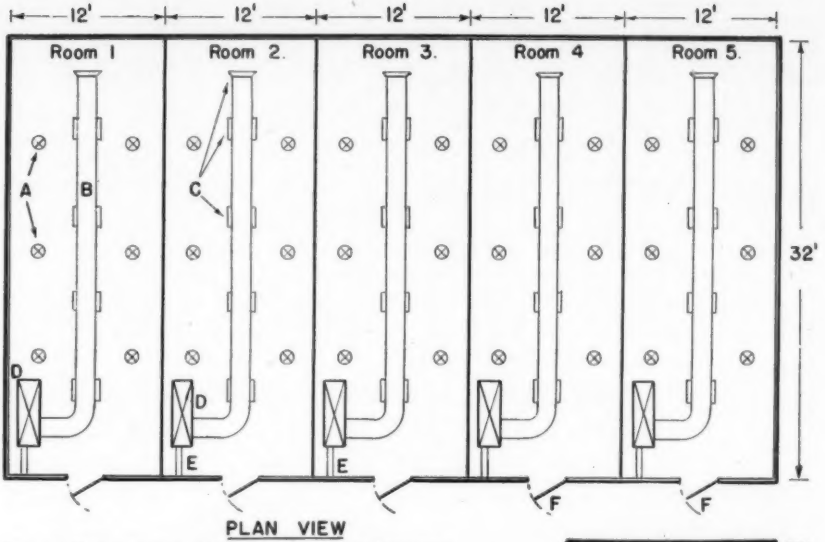

Fig. 1—Plan view of banana storage refrigerators showing location of forced-air units and ducts. The elevation at the bottom shows the location of ventilating doors. All rooms are identical.

A—Spray nozzles. C—Outlet grilles.
B—Distributing duct. D—Floor type unit coolers.
E—Ventilating ports—top port is outlet and bottom port is inlet.

2) To overcome the resistance which the ductwork offers to the flow of air, a standard 3 ton unit supplying 2000 cfm of air will require a motor of approximately .5 hp.

Heating Equipment

Inasmuch as the starting point of the banana ripening cycle is at 70 degrees, heating equipment will be necessary in the ripening rooms when the ambient temperature falls below 70°. Heat will also be necessary to raise the temperature of the product to the ripening temperature. Assuming an ambient temperature of 40°, with incoming product at 55°, the heating load based on raising the temperature of the product 2° per hour may be estimated as follows:

		B.t.u. per hr. for each room
Insulation loss	= 1472x.09x30 =	3960
Usage loss	= 2390x30x.02 =	1440
Product load	=21000x.09x 2 =	37800
		43200
Less allowance for heat of respiration and motor		8000
Net load	=	37200

Where a supply of steam is available, the most economical manner to supply heat to the storage rooms is to equip the forced air cooling unit with a heating coil as shown in Fig. 2. Where steam is not available, gas or oil heaters have been used with good success.

Equipment Installation

Fig. 3 illustrates diagramatically how the five individual unit coolers are hooked-up to a dual compressor system. Each room has its own thermostat, controlling the action of the solenoid valve at the liquid inlet of its respective unit cooler. Rather than run separate liquid and suction lines to each unit cooler from a manifold at the compressor, it is much more practical to run one large common liquid line and one large common suction line, teeing off directly at each unit as shown on Fig. 3. The wiring diagram

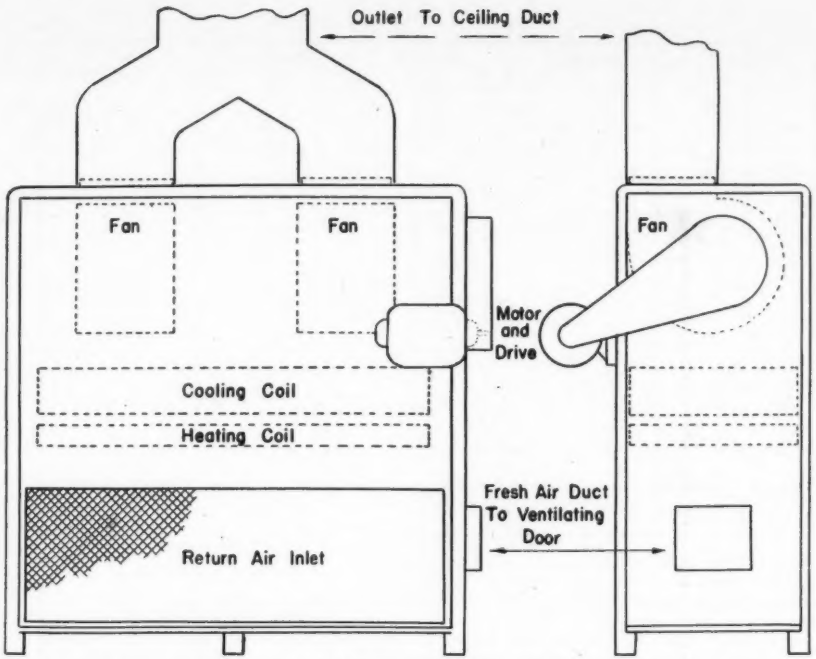

Fig. 2—Floor type forced-air unit with heating and cooling coil, showing outlet duct connection and fresh air intake duct.

for the thermostat and solenoid in the compressor motor circuit is given in Fig. 4.

Each compressor has its own pressure control which starts and stops its motor according to predetermined settings. As has been mentioned above, due to the small product loads existing at certain times, one compressor may have enough capacity to supply sufficient refrigerant to all the low-sides which call for same. By setting the pressure control on compressor "B" to cut-in at a pressure five pounds higher than that on compressor "A," this type of operation may be accomplished. This is explained as follows:

In order to maintain a working pressure of 37 lbs. freon in the evaporators, the approximate pressure control settings are 46 lbs. cut-in and 31 lbs. cut-out. The control on compressor "A" is set at precisely these settings. The settings on compressor "B," however, are fixed at 51 lbs. cut-in and 31 lbs. cut-out.

Now let us assume that the system has reached a suction pressure of 31 lbs., and that the compressors have just cut-out. The

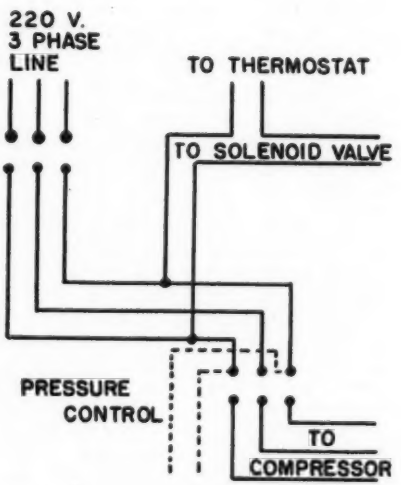

Fig. 4—Electrical hook-up of thermostat and solenoid valve in compressor motor circuit.

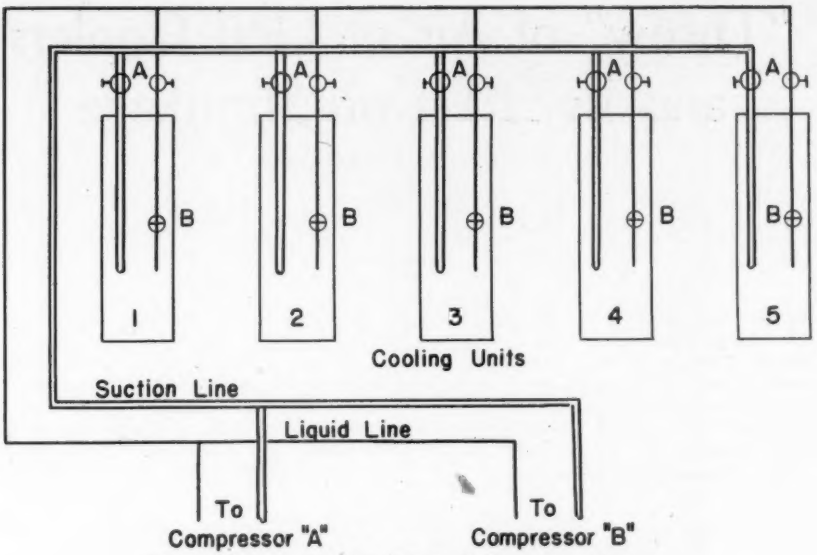

Fig. 3—Hook-up of cooling units to dual compressor system. A—Shut-off valves. B—Solenoid valves.

suction pressure will start to rise immediately until 46 lbs. is reached, at which point compressor "A" will cut-in. If only one or two of the lowsides are calling for refrigerant, then compressor "A" will have sufficient capacity to pull down the suction pressure to the cut-out point without cutting-in compressor "B." If, however, more of the unit coolers than compressor "A" can supply are calling for refrigerant, then the suction pressure will rise and cut-in compressor "B" at 51 lbs.

In order to equalize wear on both compressors, it is advisable to interchange the control settings annually, so that compressors "A" and "B" alternate in being the first to cut-in, and thus bear the maximum load.

S S S

Mr. Sim Smith

Bonham, Texas

I think you are putting out an excellent magazine and hope you can keep it up at its present standard.

F. Y. Kane

Berkeley, Calif.

Mr. Kane enjoys your magazine very much. It is helpful and constructive.

AIR CONDITIONING AND COMMERCIAL REFRIGERATION BRANCH "OUT"

OFFICIAL confirmation was received recently of the fact that the Air Conditioning and Commercial Refrigeration Branch of the War Production Board, of which the late John M. Fernald was Chief, has been discontinued.

A "Refrigeration Section" of the General Industrial Equipment Branch of the War Production Board has been formed. Mr. Sterling F. Smith is to be Chief of this Section. Mr. Charles S. Williams is Chief of the Branch.

S S S

PRIORITY RATINGS NOW OBTAINABLE LOCALLY

PRIORITIES rating for emergency repairs are now being assigned by the War Production Board to Priorities Offices in various sections of the country.

Any concern having an actual or obvious break-down, whether or not engaged in war work, and if the materials for repair will cost less than $500, may apply for preference rating on Form PD-383A.

Ratings as high as A-1-A will be assigned immediately to those concerns which meet War Production Board requirements.

"Throw" of Air of Unit Coolers and Its Effect on Shrinkage

Continued from August Issue

By J. ASKIN*

THE data given in the following paragraphs is presented as information obtained as the result of the tests conducted, and not with the thought of offering recommendations as to how high or how low the velocity of a unit should be, nor how much meat shrinkage should be allowed.

* Chief Engineer, Fedders Mfg. Co.

In order to increase the value of the curves shown, an actual example is selected.

The meats tested were small cuts placed in a wind tunnel in which the velocity could be determined very accurately. The exposed surface of the meats was measured and its condition was checked daily. The refrigerator was kept constant at a temperature of

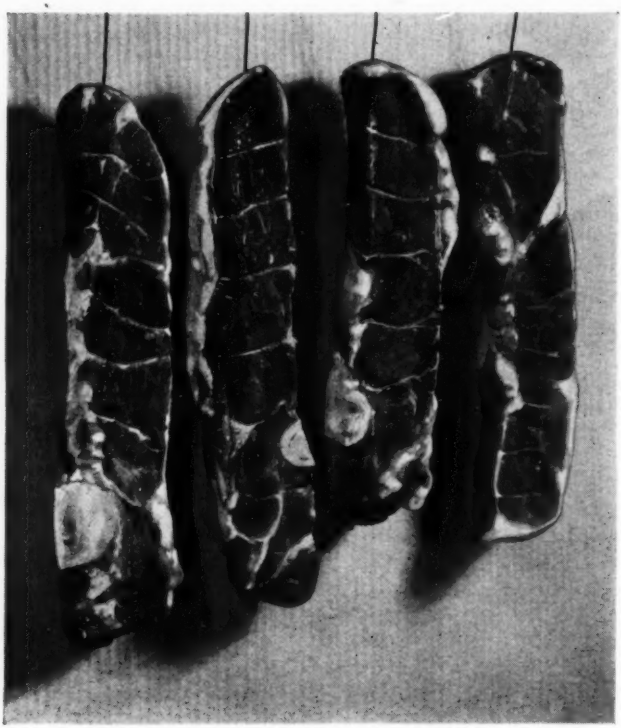

FIG. 5.

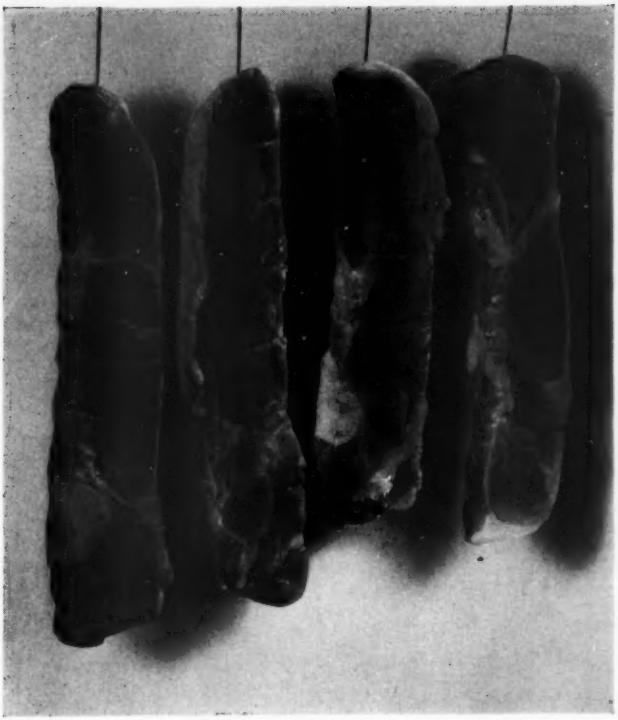

FIG. 6.

40° F. and a relative humidity of 85%. Figure 5 shows the cuts of meats before being placed in the wind tunnel. Figure 6 shows the cuts after they had been removed at the end of four days. Note that the outside surface of the meat is discolored and dry. The meat was still in fine condition after four days in the refrigerator. All that it required was trimming of the surface.

Increased Humidity

Out of interest, the refrigerator was maintained with one batch of meat at 100% relative humidity instead of 85% humidity. Although no loss of weight of the meat was found at the end of four days at the various velocities at which the meat was tested as shown in Figures 7, 8 and 9, still the meat became very slimy, bleached, and unsaleable as it developed a strong odor after two days. Results of the 100% humidity test will not be given. In the paragraphs which follow the 85% relative humidity tests only are considered.

1. *Determine Refrigerator Load.* Size 6'x8'x9' outside dimensions, insulation 3" cork. Box temperature 40° F., Room temperature 100° F.; Normal service load. T.D. box temperature minus refrigerant 15° F.; room temperature minus box temperature 60° F. According to best engineering practice, unit selected must have a box load of 4,890 B.t.u. per hour based on 16 hours of operation.

2. *Select Unit Cooler.* Unit recommended for this particular job is shown in Fig. 1, which has a capacity at 15° T.D. of 4,035 B.t.u. per hour, an air volume of 930 c.f.m., face area 270 sq. in. or 1.88 sq. ft.

3. *Determine "Throw" of Air at Selected Speed.* Face Velocity = 930 ÷ 1.88 = 497 ft. per min.

Refer to Fig. 2, if face area is approximately 100 sq. inches, Fig. 3 if face area is 400 sq. inches and Fig. 4 if face area is 800

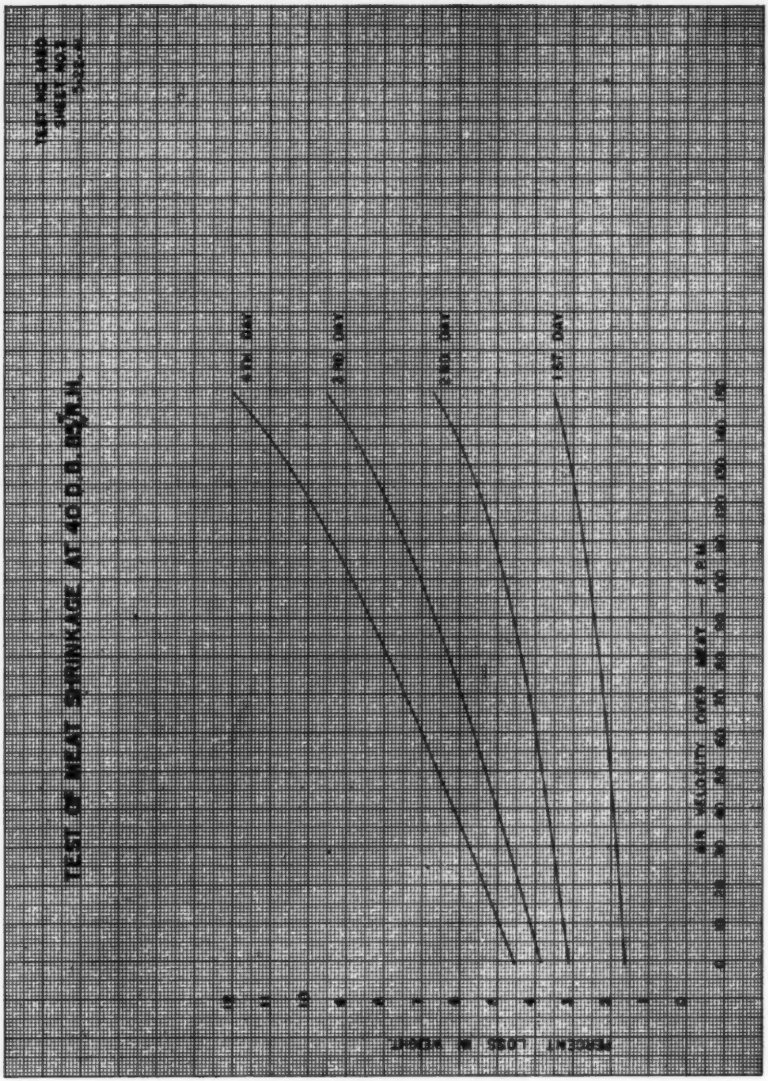

FIG. 7.

sq. inches. In this case see Fig. 3 as having closest face area. Select the proper curve by determining which curve has an initial velocity at the face of the unit of 497 ft. per min. (at 0 ft., distance from unit cooler face).

In the refrigerator the unit will no doubt be placed as shown in Fig. 10 where the distance from the face of the unit to the door would be approximately 5½ ft.

From Fig. 3, at a distance of 5½ ft. the velocity to be expected would be 370 ft. per minute. Offhand we would think that this

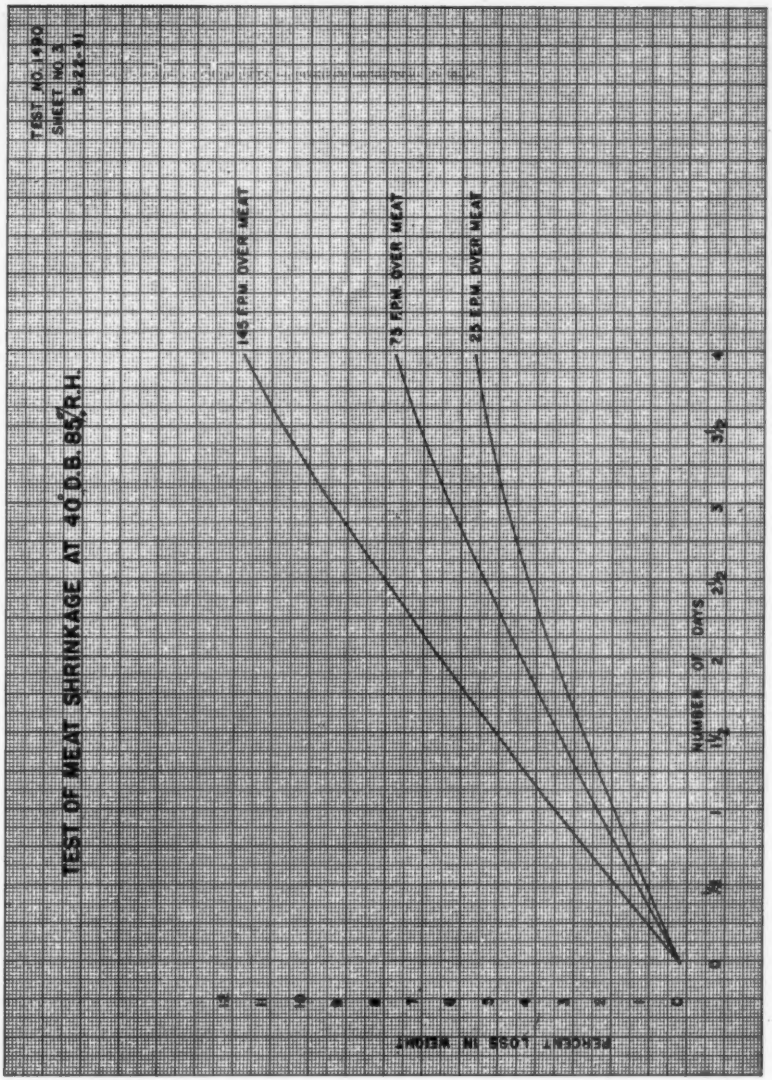

FIG. 8.

velocity would be too high, or the "throw" of air of this unit would be too great. Actually the velocity of air flowing past the surface of the food hung in this refrigerator is relatively low as shown in the following computation.

4. *Compute Air Velocity Along Walls.* Having a velocity of 370 feet per minute near the wall on the door side, and an air volume of 980 cubic feet per minute the space at which the "throw" of air would spread would be.

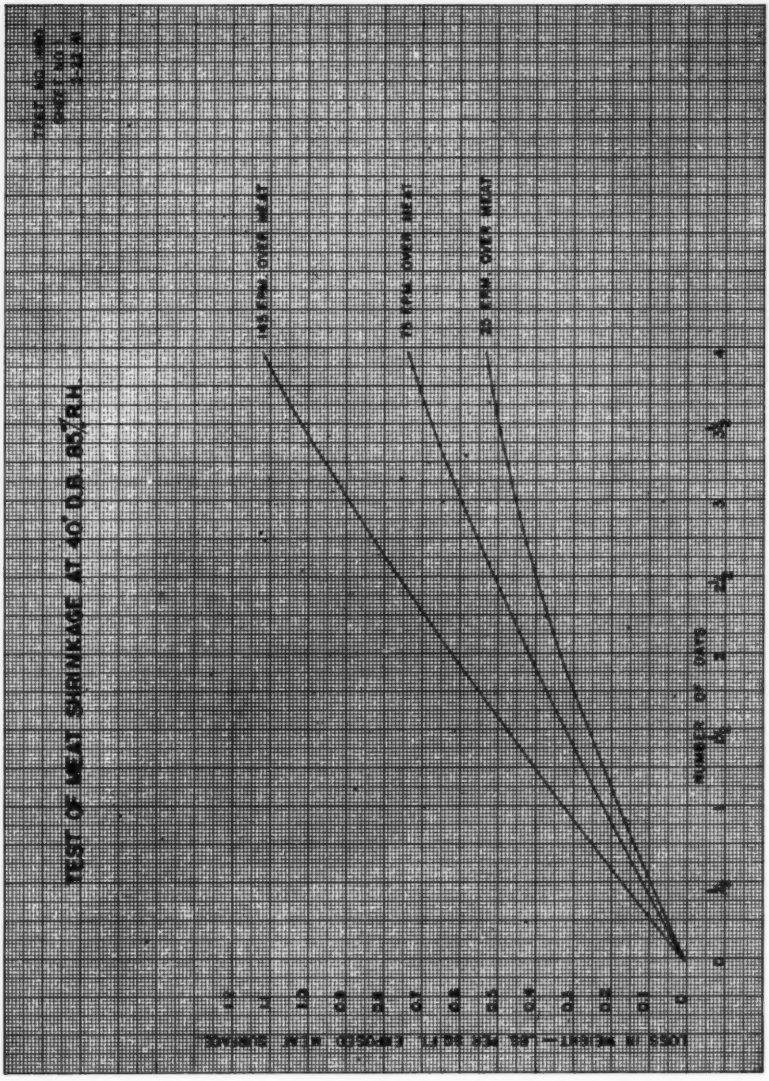

FIG. 9.

$$\frac{930}{370} = 2.5 \text{ sq. ft.}$$

The face area of this wall is $5.5 \times 7.5 =$ 41.25 sq. ft.

$41.25 - 2.5 = 38.75$ sq. ft. available for the return air.

The air, in returning along the two side walls and along the floor and ceiling to the suction side of the fan would be expected to have a velocity of $\frac{930}{38.75} = 24$ ft. per minute.

(Continued on page 30)

COMMERCIAL

INCREASE BUSINESS BY DOING A MORE EFFECTIVE JOB OF SELLING *Selling*

Two St. Louis Churches Adopt Air Conditioning to "Meet Competition"

By Robert Latimer

A PRIORITY-BEARING field which is logically open to the refrigeration and air conditioning engineer, but which has only to a small extent been explored, is air conditioning of churches—particularly those larger religious edifices which are so located that a congregation member enroute to church on a hot Sunday evening can easily switch his mind and go to a comfortably cooled theatre instead. These latter, according to John M. Robertson, air conditioning engineer of the E. K. Campbell Heating Company, St. Louis, are many —and they represent a field which the Campbell concern, specializing in refrigeration, has been able to produce some of its most unusual and successful air conditioning installations.

"Refrigeration men universally shy away from church work because there is a general misconception that it is low-profit, slow-paying work," Mr. Robertson told THE REFRIGERATION SERVICE ENGINEER. "But actually among the larger churches appropriations are being put aside for air conditioning on a regular schedule, and in other cases, wealthy members put up the whole sum on their own. There are less than 150 air conditioned churches in the United States despite the fact that this country has more air conditioning installations than the rest of the world put together. That makes it look like someone is overlooking opportunities."

Typical of the thinking of this St. Louis firm is the Tower Grove Baptist Church in St. Louis, one of the largest suburban churches in the city and now one of the only two air conditioned religious structures in Missouri. Mr. Robertson contacted the reverend head of the Tower Grove Church more than a year ago with the suggestion that air conditioning might be the answer to falling off each summer of the congregation—sometimes by 500 members at a time. The church is located near a large amusement area with many cooled theatres, bowling alleys, etc., which offset the 100-degree St. Louis temperatures, and many of the congregation had undoubtedly strayed in this direction. As a solution Mr. Robertson suggested that pollen free atmosphere of controlled humidity and temperature would not be disrespectful to the purpose of the church in any way while aiding it to reach more people. "The reverend agreed with me," Mr. Robertson smiled. "Stating that he didn't agree with the type of theology which says 'come to church and suffer.'

He concurred with the wisdom of installing cooling facilities, and by keeping after the job, I converted the entire board of members to appropriating a fund for the purpose."

Last Word in Economy

The system installed is a "model job" from the standpoint of economy and efficiency, and is being adopted by other churches, since it gives the same cooling effect as 300 tons of direct-expansion cooling with only a 15 ton compressor manufacturing ice during the periods between use. Since the church, which has more than 200 rooms for various purposes and a central auditorium seating between 1200 and 1500 persons, is used only on Wednesdays and Sundays, it was possible to develop economical ice-plus-refrigeration cooling in the space between.

15-Ton Unit Used

The entire church is air conditioned by means of a 15-ton York compressor which freezes 28 tons of ice continuously in a 30x12x6 foot ice tank in the basement. It requires approximately 72 hours to freeze enough ice for cooling the building for eight hours under its heavy, but short-time load. Cooling begins early Sunday and Wednesday mornings, when ice water is circulated through copper finned coils in the main plenum chamber after passing over the ice in the ice-making tank twice. Four banks of coils handle 250 gpm of chilled water, with a 50,000 cfm blower housed in a plenum chamber in the rear basement under the auditorium rostrum. Ductwork is arranged to discharge cooled air into the main auditorium at a point above the heads of the congregation through anemostat-type grilles, distributing it evenly over the space. Smaller ducts serve the meeting rooms, Sunday Schools, class rooms and other rooms on all sides of the building, according to the amount of heat load which must be met.

Water in the coils is chilled to 35 degrees, which reduces temperature in the church to 80 or less within three hours of operation. During the winter a warm air furnace is connected with the main plenum chamber to distribute warmed air through the same system—dispensing altogether with inefficient, leaky radiators which had produced a staggering heating cost for the large church. Through the week, when small meetings are held for special reasons, sufficient cooling can be applied for specific rooms while not affecting the ice supply being built up for the next all-day use. The system will take in 75% fresh air if desired, but recirculates 50% under normal use. According to Mr. Robertson, congregation levels reached winter normals immediately after the cooling program began and has remained there since. Thus, the church is "meeting competition" effectually.

Other Churches Sold

Another large church installation completed about the same time was made at the Third Baptist Church, famous church on Grand Boulevard in the heart of the St. Louis theatre district, where competition in the words of Oscar Johnson, pastor, was "tremendous" in the summer months. Here Guaranteed Heating & Engineering Company, another refrigeration-heating firm, has installed two 25-ton Frick compressors of direct expansion type which freeze 75 tons of ice continuously for meeting and regular events daily through the week. Fan chamber and coils through which chilled water is pumped are located in the west end of the basement, and have the huge job of cooling the building for 2500 and more in congregations. These are so large at times that amplifiers have been installed in basement classrooms and meeting rooms, so that those attending may hear the sermons comfortably. The Frick system operates on a continuous basis making ice, switching from one compressor to another to serve two "ice battery" tanks, and is likewise economical through serving over an extended period.

"There's no reason why churches should not be on the prospect list for every refrigeration firm" Mr. Robertson summed up. "If the company will make some attempt to educate congregations to its benefits."

"Specialize Through Emergency" Says St. Louis Refrigeration Man

By Herbert Hanley

IN the very fact that refrigeration service volume can be expected to expand substantially during the next year or two lies a considerable amount of danger for the refrigeration service firm which tries to "bite off more than it can chew" according to Stephen Aspiomonte, head of the University City Refrigeration Service Co., University City, Mo. "A lot of us are going to be handling business in amounts two or three times what we are accustomed to "Mr. Aspiomonte points out" and many of us will try to add additional departments, and to spread into all branches of service because we feel there is a larger profit involved. However, with the parts situation, being what it is, the likelihood of gas rationing, and the need for tire conservation, I believe it wisest to specialize in one or two branches of refrigeration through the whole emergency."

The University City Refrigeration Service Co. now six years old, has been operating in this popular suburb of St. Louis since its founding on the idea of "Specialization"—which Mr. Aspiomonte found the quickest way to a profitable business, and now, the best solution to the "new market" brought about by the lack of new refrigeration equipment. His two specialties are frosted-food cabinet service and upkeep, and contracts for individual service on apartment house refrigeration—either of the multiple or individual unit type. There are no other service firms in the St. Louis area who concentrate specifically on these two lines; consequently, Mr. Aspiomonte started right out by "prospecting" among people using these two types of refrigeration, and got his business under way in a matter of months, instead of the year or more ordinarily required with all-phase service. During the remainder of the war, Mr. Aspiomonte simply planned to turn down all domestic and small refrigeration service which he isn't equipped to handle with a two or three men staff—and to stick to his apartment house and frosted food cabinet work. "We are already turning down a large amount of domestic calls because we have not the time or the parts inventory," he said, "but have worked out an arrangement whereby we relay such customers to nearby domestic service companies providing the latter are able to answer the call."

All men at University City Refrigeration Service Co. are experts on deep-freeze frosted food cabinet work. On list at present are more than 350 customers, including six national frosted food manufacturers, grocery stores, drug stores, super markets, delicatessens, dairy plants, and department stores. None of this work is done under contract—although originally a certain amount of it was set up that way. Now, a flat rate of $2.50 an hour, slightly higher than for domestic refrigeration service, is charged. Formerly, Mr. Aspiomonte made arrangements for this field with frosted food distributors or wholesalers who owned their own cabinets, but since last year all cabinets were sold individually to the stores operating them, it is now a single-customer-at-a-time proposition. The shop contains complete facilities for sharp-cold work, and can refinish and repair exterior surfaces, as well as refrigeration. Mr. Aspiomonte covers the whole city in this field, which amounts to about fifty percent of volume.

Forty-five percent more of the volume is in apartment-house work, another specialty in which University City Refrigeration Service Co. stands out. There are many large apartments in University City and Western St. Louis operated by realty management firms which still contain multiple-refrigeration systems which Mr. Aspiomonte services on a contract basis.

Though many other service men shy away from contract work, Mr. Aspiomonte has made it profitable through simply spending plenty of time inspecting the equipment before setting the rate, and then making this higher to compensate for hidden costs. His rate is slightly above that of competitors—but he has never lost a customer. "We justify our rates by inspecting refrigeration equipment all winter long, as well as summer," Mr. Aspiomonte said. "I keep all the equipment scrupulously clean, which is the only way to detect future needs for repairs, and try to catch everything before it actually occurs. We keep a complete inventory of parts, and many realty firms call us for refrigeration service as a matter of course."

Apartment includes both multiple systems and individual-refrigerators also owned by realty firms. All individual units are handled on a flat rate of $1.50 an hour, while most multiple work is on a contract basis. Mr. Aspiomonte has facilities for replacing compressors altogether, for building new equipment where restrictions make it impossible to obtain parts, and has exercised considerable ingenuity in keeping old multiple systems "alive." A point which he impresses upon other service men in this field is full attention to the parts situation. "We tell apartment owners and realty firms to set up an inventory of parts if this is at all possible," he said, "advising the apartment owner that if he can obtain sufficient priority rating, it will be wise for him to buy inventory of parts to guard against any kind of breakdown. We explain that we are entitled to parts, but it is simple logic for the owner of the system to likewise own the parts. Thus, we will buy complete small inventories, sell them to the realty firm at our price, and then keep them in our own stock or deliver them to the realty firm as they wish. I think that this is an important means of protecting our own business, as well as insuring that refrigerators will continue to operate well into the future." The firm does a very small amount of domestic work—"mostly for friends"—but plans to give up this field altogether as the peak summer months go along.

Decentralized Arrangement for Giant Defense Cafeteria

ONE hundred per cent efficient service facilities, protected from breakdowns and other damage by the fact that every section is made up of separately-operating units is the feature of the huge amount of equipment which went into the new cafeteria of the Wright Aeronautical Corporation, Rockland Heights, Ohio, built in four months to provide complete food service facilities for the 10.000 workers needed to turn out the aircraft company's heavy defense contract. One of the largest cafeterias in the world, it is located in a separate building amid the many aircraft production plants, and is arranged to seat 5,000 persons in single shifts. In reality, the building is composed of seven distinct cafeterias, each of which can be thrown into service or withdrawn according to the amount of traffic passing through.

Each of the seven major units is equipped with "food-bank" equipment which makes it possible to prepare foods during the night or morning for lunchtime service. Breakdown-free refrigeration, as an outstanding necessity, has been unitized into 46 parts, with 46 direct-expansion compressors serving 112 food storage, ice-manufacturing, freezers, ice cream making equipment, and other service units. The equipment installed by York Ice Machinery Corporation includes a 70 by 12 foot five-compartment cork and cement meat cooler, equipped with stainless steel self-sealing doors, twenty small stainless steel coolers for salads, desserts, and fish, a variety of smaller reach-in coolers through the kitchen, each split into small compartments with separate thermostat controls, each group controlled by an individual temperature selector. There are 18 self-service ice cream cabinets, 8 reach-in dairy refrigerators, 8 high-capacity water coolers, and more than 50 small reach-in boxes for short orders, desserts, and bottled soft drinks. Shaved ice for the more than 1000 ft. of cold foods counters are provided by two ice-making machines which turn out four tons of chipped ice per day.

Self Service Meat Market in Los Angeles Super

By Donald Delayen

HELPING "food win the war" is the new 100 per cent self-service meat market of the Caler Grocery Company at 4201 South Figueroa St., Los Angeles, Calif., which by means of specially-refrigerated display cases, has made it possible for customers to "sell themselves" entirely on any meat from frankfurters to sirloin steaks.

Everything in the market, including poultry, prepared meat and sea foods, is shown in refrigerated display cases which have replaced the former display type of glassed-in case. The department, occupying one wall of the store on the left, consists of a standard refrigerated cooler, two small cutting rooms, and fifty-foot case made up of three "blanket cold" self-serve cases where pre-packaged meats are arranged in neat rows. Customers here find meat which has been carefully cut from bulk stocks in the main cooler by butchers who have more time to cut carefully now that they no longer have to spend part of their time in selling. Each meat purchase goes through the checkout stand at the front of the market the same as any other goods carried in the store, with the exception that it is weighed twice to keep a full-profit ratio. Customers now can shop in 30 to 50 per cent less time than formerly required, since there is no waiting while one customer is receiving her merchandise. "In the past self service was wasted to some extent when the meat market came into consideration" reports Dudley Scott, vice president of the market. "The housewife who saved 20 minutes in serving herself around the grocery department often found that she lost the time gained by standing aimlessly waiting for service at the meat counter."

Self service has simplified the whole job of selling meat for the market. First, the cutting rooms are only a few feet away from the display cases, where pre-cut meats can be placed on a light wheeled table and pushed over for assorting in the case. Butchers now concern themselves with nothing but their own work; do not have to direct customers to other departments, give out advice on cooking, etc., which took up a lot of their time before. Lastly, it may even be possible to eliminate altogether the use of the expensive-to-operate large walk-in coolers, inasmuch as there is ample space in 28x30 inch storage lockers along the bottom of the main display case to keep a day's forward stock. If this works out, Caler's Grocery will remove the coolers altogether, and cut all fresh meats for sale early in the morning for each day's stock, saving several dollars per day in operating cost, as well as releasing the time of needed employes for other market jobs.

All meats when cut are wrapped in cellophane, and given a small sticker which names the type, gives its net weight, price per pound, and the full price of the piece. This answers all questions for the customer in advance. Formerly it was feared that customers would rumpus through the meats and spoil the display appearance but it has been found that most housewives carefully replace all meats which they do not buy after handling. "They regard meat and our methods highly enough not to take advantage of it" Caler grinned.

The display case is supplied with a 3-ton compressor and has sixteen heavy duty refrigerating coils for blanket cold averaging 37° at the bottom to 42° above the display. Originally the case was open at top, but Calers was asked to put sliding glass doors on them by Los Angeles Sanitation Bureau to keep out dust, etc., and prevent setting a precedent for markets in poorer areas where the idea might not work out. Customers push back the door to get the meats, but this has not slowed up the increase of 20 per cent in sales.


Here's how
FREON
refrigerants
measure up
in wartime
FREON-12

IN THE YEARS before Pearl Harbor, more new tonnage of refrigeration machinery was being built for "Freon" than for all other refrigerants combined. That's still an important fact, because it shows the wide acceptance of "Freon" by the refrigeration and air conditioning industry—but of still greater importance is the way "Freon" meets present-day conditions. Here's how "Freon" measures up in wartime:

No other refrigerant is safer for home, industrial, or military installation. "Freon" was developed by Dr. Thomas Midgley, an American, to meet American industry's insistent demand for a group of non-toxic, non-flammable refrigerants. It meets all specifications for safety of life and property set by the U. S. Bureau of Mines and the Underwriters' Laboratories.

It's harmless to foods and textiles. There is no danger of loss of food or other vital supplies when refrigerant leakage occurs if "Freon" is used. These facts, coupled with "Freon's" other safety properties, make it possible to place a "Freon" installation practically anywhere—even below decks on shipboard!

Non-corrosive to metals that are used in refrigeration equipment. In peacetime this permits selection of metals which provide maximum heat transfer and efficiency. Today it leaves designers of "Freon" equipment free to substitute *available* metals for those unavailable or on the critical list due to war shortages.

Efficient in all size units—"Freon" is as adaptable to small, fractional horsepower units as to commercial refrigeration equipment of hundreds of tons capacity. For example—a large majority of the electric household refrigerators built in recent years used "Freon," yet this refrigerant is also used in equipment furnishing over 23,000 tons of refrigeration for air conditioning our Nation's Capitol and other large government buildings in Washington, D. C.

Available from adequate supplies—Plant capacity and raw material supplies have been adequate since early this year and remain adequate, to furnish "Freon" for all permissible uses in the United States and friendly foreign nations. Furthermore, stocks of "Freon" are maintained by this company in 35 warehouses strategically located throughout the country. And this is in addition to stocks in the hands of thousands of distributors and our armed forces.

Thanks to these factors, and to the careful use of refrigerants and prompt return of cylinders now practiced by the industry, there should be no shortage of "Freon"—the refrigerant best fitted to do a wartime job on every front!

KINETIC

FREON

REG. U. S. PAT. OFF.

safe refrigerants

"Freon" is Kinetic's registered trade mark for its fluorine refrigerants

KINETIC CHEMICALS, INC., TENTH & MARKET STREETS, WILMINGTON, DELAWARE

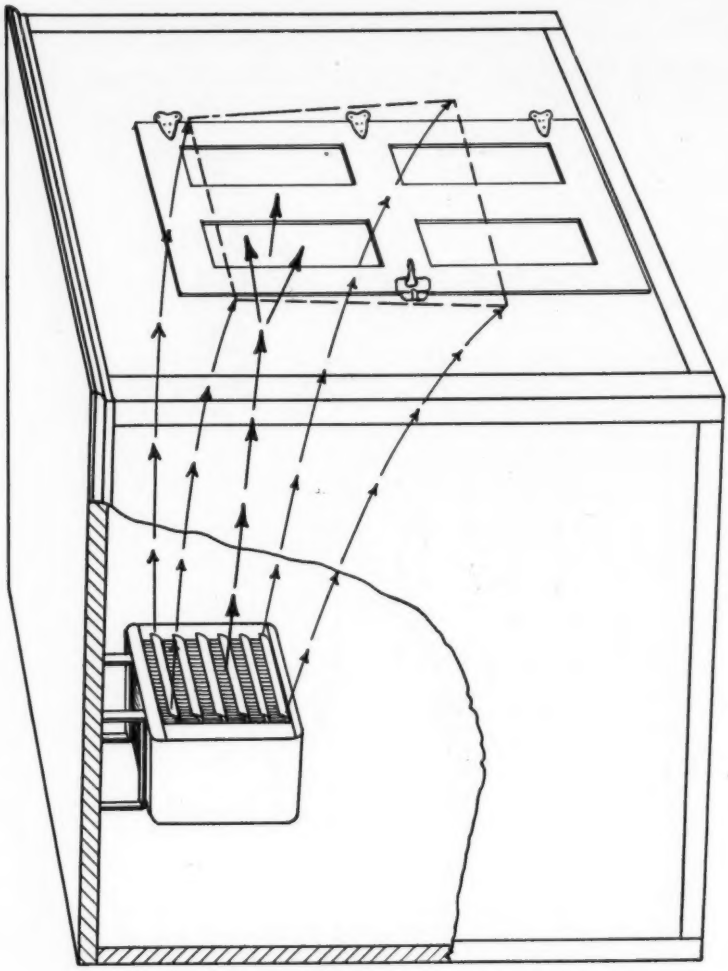

FIG. 10.

"THROW" OF AIR OF UNIT COOLERS AND ITS EFFECT ON SHRINKAGE

(Continued from page 22)

In other words, the sweep of air past the meat hung along the side walls would be at a velocity of 24 ft. per minute.

5. *Determine Meat Shrinkage to be Expected.* The tests are based on small cuts as mentioned before.

From Fig. 7, at an air velocity of 24 ft. per minute the meat shrinkage to be expected at a box temperature of 40° F. and relative humidity of 85% is 1.8% at the end of the first day, 3.4% at the end of the second day, 4.5% at the end of the third day and 5.5% at the end of the fourth day.

Fig. 8 shows the same results, the curves being plotted with the abscissa as "Number of Days" against ordinate of "Per cent Loss in Weight" for various velocities over the meat.

To a butcher neither Fig. 7 nor Fig. 8 are likely to be useful unless he keeps small cuts in a display case, ready to be marketed.

More useful curves which would enable a butcher to anticipate weight loss irrespective of the size of the cut are shown in Fig. 9. In these curves the "Number of Days" is plotted as the abscissa against the "Loss in Weight" as the ordinate. And this loss in weight is expressed in "Lbs. per Sq. Ft. of Exposed Meat Surface," a much more logical criterion for shrinkage of meat. It is well known that the surface of a piece of meat not exposed to the air stream does not dry out.

For example a "large cut," a side of beef hanging against the wall so that only the front is exposed to the air stream and having about 2.5 sq. ft. of exposed surface, weighing 125 lbs. would only have lost $.52 \times 2.5 = 1.3$ lbs. at the end of 4 days in a 40° box, 85% R.H. and an air flow of 25 ft. per minute over the meat surface, a surprisingly small amount.

Should the Jobber Enter the Repair Business

In the following letter, received by the editor, comments are made on the article entitled "From Replacement to Repair" which appeared in the August issue. The writer of the letter takes issue with the growing thought that the jobber should enter into repairs. His reasoning is most interesting.

Editor: I have read with a great deal of interest the article in the August issue of THE REFRIGERATION SERVICE ENGINEER written by my good friend Mr. Ernie Tramposh.

Most of the article I heartily agree with; however, I would like to enter into a friendly debate on one issue and this is the jobbers adding a service shop to their operations.

For several years the refrigeration supply jobber has been fighting for recognition as an essential part of the refrigeration industry, and one of the main reasons that he has finally gained this recognition, and the very thing that we have used to build our Jobber Association with, is that we did not compete in any way with the service business, and that our part was to *cooperate,* not compete. In my opinion, this *cooperation* is more necessary now than ever before; certainly not competition.

Secondly, if it is impossible for the present refrigeration service concerns to obtain competent service men, and additional equipment to enable them to repair old parts, how is the jobber going to do it, starting from scratch? Wouldn't it be better for the jobber to advise and help the concerns still in business to obtain the equipment and men from those who are quitting?

Our experience in this territory is that the shops that are quitting are mostly independents who were not any too well established, which leaves the well established shops, which are in a much better position to add equipment and men than the jobber.

Also, every item that is in the jobber's stock is available to the service man. If this is not sufficient, how is the jobber going to make any more out of it, by having his own shop?

One may ask how the jobber is going to stay in business with only a few customers left to sell to. My opinion is that he cannot with only those customers, but new customers are being created every day by

installations in Army Camps, munition plants, and all other Government agencies. They all use refrigeration equipment, from water coolers in the offices to large process installations in the plants. The jobber can get the orders for a big part of the original equipment through contractors, besides the spare parts business, and more especially serve the war effort by having *emergency* parts available for these Government installations, who have their own service men.

The refrigeration supply jobber has gained his place in the sun. We are more essential now than ever before, even though sometimes it seems that the whole refrigeration business has been forgotten. But let's not do anything now that will give those who cried so loud five years ago that the jobber was a parasite, not necessary, competing with the dealer, etc., a chance to say, "I told you so—when the going got tough, they went into competition with us, and helped to shove us out of business." Rather, let the refrigeration industry say that the jobber, even though the going was plenty tough, stayed in his place and did his bit for the war, and helped the service business to do likewise.

Another thing that may make the jobber, as a jobber, more necessary than ever is the concentration of industry that is being considered by the Government. In other words, if the Government appoints one plant to manufacture valves, another coils, etc., it is certain that this one factory is going to have enough to do, without dealing with service concerns direct. They will certainly need the jobber to distribute the items for them. If this change comes about, it will be an appointment for the jobber (if he is still a jobber) to further prove how necessary he is, not only for essential civilian needs, but to serve the ever increasing emergency needs of the Army and Navy, and other Government agencies.

The going will be tough, but by adjusting our overhead expenses to fit our sales, aligning ourselves with all Government regulations, taking advantage of all priorities and PD-1X forms to obtain material, I for one believe we can go through as jobbers. It is true that all business from here on out will be repair and maintenance business, but we, as jobbers, are in that business. Let us stay in it and supply repair and maintenance parts and not go into the installation and service business. And when the war is over we will be there for our manufacturing friends to sell to, and it will not be necessary for them to look through a maze of service concerns to find what used to be a jobber.

Very truly yours,
H. R. McCombs,
McCombs Refrigeration Supply Company.

WPB RELEASES 50,000 FROZEN REFRIGERATORS FOR SALE TO GENERAL PUBLIC

THE War Production Board on September 5 released for sale to the general public about 50,000 domestic mechanical refrigerators which had been frozen in the hands of dealers and distributors since February 14. The Board also established a program for transfer of refrigerators held by manufacturers and their affiliated distributors to retail dealers and other outlets. This program, it was estimated, eventually will release another 50,000 to the public. The order, WPB said, will facilitate acquisition of new refrigerators by consumers who certify they have no other refrigeration equipment at their disposal.

Independent distributors with frozen stocks of gas and electric refrigerators may release, through their usual channels of distribution, refrigerators which they had on February 14, the date of the original freeze order.

Retail dealers holding gas refrigerators also are permitted to sell those which they had on the same date. There has been no restriction since March 26 on sales of electrical refrigerators held by retail dealers. Kerosene operated refrigerators were not released because of the limited supply available for war agencies. The released refrigerators are chiefly of the deluxe type not suitable for military use.

The Office of Price Administration announced that manufacturers' and distributors' maximum price for the sale of refrigerators released by the WPB would be established within a few days.

Henry Products Follow the Flag!

AT HOME • ABROAD • ON THE SEA . . .

Today—let's concentrate only on winning the war. Nothing is more important than restoring human rights to enslaved millions and making our own precious Democracy secure. Because Henry Products are needed by the armed forces, our workers, our machinery and our resources are in the service until an all out Victory is achieved.

PACKLESS AND PACKED VALVES • STRAINERS • DRYERS FOR REFRIGERATION AND AIR CONDITIONING
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HENRY VALVE CO.

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Refrigeration Is Taught to Trainees at Camp Lee

By Sgt. Richard Leighton*

MODERN refrigeration has had at least as important an influence on the development of supply technique in armies as it has had in modern civilization generally. The enormously increased mobility and operating range of large modern armies over the smaller professional armies of the eighteenth century is due at least in part to the ability of modern forces either to carry their own food supplies with them or to bring them long distances from the rear. To be sure, the armies of Hannibal, Caesar, Gustavus Adolphus, Napoleon and other generals carried on operations that would be considered extended even by modern standards, but their forces were small by comparison with those of today; moreover, they performed miracles through efficient supply organizations, and despite primitive means of transport and preservation of perishables. Large migrating bodies in the past have also traveled far, but only by living off the country.

When we consider how few countries or regions even approach self-sufficiency in foodstuffs, it is easy to appreciate this aspect of the supply problem of the modern army on the move. The amazing feats of Genghis Khan's Mongol cavalry, which was able to traverse degrees of longitude with little more subsistence than the dried meat each man carried in his saddle pack, an occasional drink of blood from the veins of his pony and milk from the mare cannot be duplicated under modern conditions of warfare. Food must be transported over great distances and stored for relatively long periods. This means, in the case of perishables, refrigeration.

One of the earliest instances of artificial refrigeration in armies is recorded in the campaigns of Alexander the Great, who packed snow in trenches to cool wines for his soldiers. Since artificial refrigeration in modern times, however, dates back no further than the middle of the last century, the use of refrigeration in the United States Army is a comparatively recent development. Mechanical refrigeration, of course, is still more recent.

The Mexican Rebel Cavalry of Pancho Villa prevented spoilage of its meat by the great use of pepper and spices, but Villa was one of the modern exponents of military refrigeration. It was through his efforts that the Mexican Republic started on a national refrigeration program.

In the Quartermaster Corps, which is responsible for the procurement, storage and issue of subsistence supplies (among other things), refrigeration equipment is widely used in almost all theaters of supply and operation. Since the problem of supply is present in various forms all the way from the procurement to the consumption of food, methods of refrigeration must be adapted to all types of transportation and storage, and to all climates. The Quartermaster refrigeration specialist must not only operate, but maintain, refrigerating cars and trucks, packing houses, cold storage warehouses, and both ice and mechanical refrigerating equipment. Finally, he must know how to preserve perishables without special equipment of any kind.

Training Soldiers

Training quartermaster soldiers for this job is the function of the Refrigeration School at Camp Lee's Quartermaster Replacement Training Center. The school, one of 22 in the Supply Training division directed by Col. John V. Rowan, is headed by Captain Allan Johannesen, a former engineer for a chain of ice, meat curing, and storage plants in Florida. Assisting him as instructor is L. K. Wright, who was for 12 years in charge of the Refrigeration Branch of the New York YMCA Trade and Technical Schools. He has been a member of the American Society of Refrigerating Engineers since 1926 and of the American Society of Mechanical Engineers since 1928, and is the author of half a dozen books and many technical articles. During the last

* Public Relations Office, Quartermaster Replacement Training Center, Camp Lee, Virginia.

The hidden enemies that lurk in all perishable foods—bacteria which cause decay and spoilage — can be successfully combatted by only one weapon: efficient refrigeration.

That's why the All-Industry Program to conserve existing refrigeration equipment is so vital to our nation's welfare. Food is being produced in greater quantity than ever before. It must be kept wholesome and nutritious.

Penn pledges full co-operation with Refrigeration Service Men to keep equipment functioning efficiently. Our engineering department will gladly help you solve exceptional repair or maintenance problems. And where existing control equipment must be replaced we are prepared to furnish the needed controls, under established priority regulations. *Penn Electric Switch Co., Goshen, Indiana.*

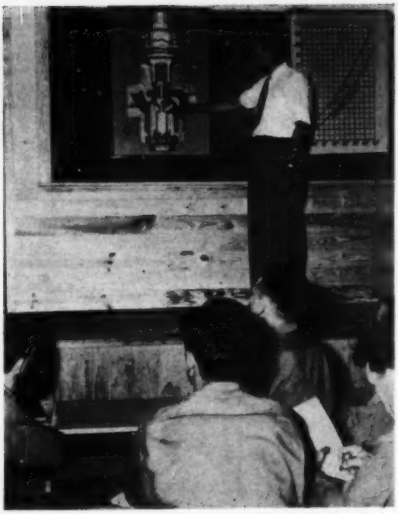
PENN
CONTROLS

war, he carried on much experimentation in engineering designing, and has filed 30 patents for refrigerating devices alone.

The course of training has two main phases; subsistence, which concerns the storage and issue of perishables; and refrigeration mechanics, which concerns the operation and maintenance of refrigeration machinery. Most men trained in the school are destined for eventual assignment to a refrigeration company, and particularly for the cold storage and refrigeration platoons within the company. A refrigeration company also includes a butchers' platoon, attached veterinary personnel, and a headquarters platoon composed of a company headquarters, administrative section and a Plant Service Section. To each refrigeration company, for field operations, there is normally assigned as many as 80 mobile trailer-truck refrigeration units. These units are advanced type of refrigerator truck, employing the latest developments in mechanical refrigeration. A gasoline-driven, compressor-type refrigerating system is used, capable of producing a wide variation of temperature for long or short hauls and frozen or fresh foods. A gasoline engine, a rotary compressor, a fin-type condenser, and both the blower and plate-type evaporator, comprise the mechanical equipment. The refrigerant is Freon (F 12). Each trailer unit has an operating crew of two men—mechanic and driver—but loading and unloading is performed by trained refrigeration personnel.

Normal functions of quartermaster refrigeration specialists in a permanent Army post or station call for the same kind of training, by and large, as is required under comparable conditions in civil life. Trainees at the Refrigeration School study the general principles of ice and mechanical refrigeration; mobile refrigeration by railway car and trucks; household refrigeration and air conditioning; and food preservation. Most of their training is practical, however. There is considerable laboratory work, in which the trainees actually operate refrigeration equipment, disassemble and assemble compressors, weld broken parts. There are trips to large cold storage plants in the neighborhood, and inspection of the equipment used at Camp Lee.

Much attention is given to methods of overcoming the hazard of field operations. Mechanical refrigeration equipment is delicate as well as bulky; cold storage plants and refrigerator cars are targets for bombers. Where ice is available, a double-walled box, insulated with sawdust, shavings, or straw makes a fairly good refrigerator, particularly if it is sunk partially in the ground, and protected by a canopy of canvas or tree branches. Camouflage, in refrigeration as in every other activity of the army, is of vital importance.



By means of a combination cut-away section and colored chart, trainees at the Refrigeration School of Camp Lee's Quartermaster Replacement Training Center are showed the workings of intricate refrigerating machinery. L. K. Wright, civilian instructor in the school, explains the model. He is widely known in the refrigeration profession for his contributions to the field.

Refrigeration is also possible without ice. A wooden frame with solid wood ends is covered on three sides with non-rusting wire screening. A door, also screened, is fitted on the fourth side. The whole is then covered on all sides with cotton flannel, the top edges of which are immersed in a pan of water on top of the cabinet. If the atmosphere is fairly dry, a temperature as low as 55 degrees F. can be obtained. Naturally the box should be small, and should be kept in the shade. The same principle of evaporation can be applied effectively to a tent, tightly sealed, with the water allowed to soak up the sides from shallow troughs.

Another effective method is by diverting

Put the HEAT on Hitler

... by

keeping machine tools COOL

Help boost war output with G-E "Scotch Giants"

YOU can do a lot to help war production plants in your territory. Show them how—with "Scotch Giants" to cool lubricating oil—vital machine tools *run longer hours*, maintain tolerances, turn out their *maximum* in both quantity and quality!

Many war plants near you should be good prospects for such new installations —for *additional* stand-by units—for regular inspection and maintenance service. In addition, new and unusual uses for G-E cooling are being found almost daily in war production. Wherever you find a cooling problem, there's a job for a G-E "Scotch Giant" condensing unit.

General Electric Company, Division 2719, Bloomfield, New Jersey.

"Scotch Giant" Condensing Units are available in a wide range of air and water cooled models in ratings from ¼ to 125 hp. They provide trustworthy, long-lived, low cost refrigeration.

GENERAL ELECTRIC

"Scotch Giant" Condensing Units

a mountain stream to flow over the roof and sides of a building—an adaptation of the spring house, familiar to most rural communities in the United States. This and other methods are demonstrated to trainees in the school by means of scale models, which the men build themselves.

Improvisation and experiment figure prominently in the school's activity. Much of the "lab" work consists of experimentation in refrigerant solutions, use of common materials for insulation, and the like. One result of experimentation in insulating materials, for example, was the discovery that sand, frequently recommended as insulation for rough, temporary refrigerating cabinets, is actually quite unsatisfactory; it has a "K value" (the term used to measure insulator efficiency) of 7.8, whereas a good insulator should not be greatly in excess of .25.

Insulating Materials Tested

Recent experiments at the school with ordinary dry leaves as an insulator have had promising results. Under Mr. Wright's direction, the trainees are testing the comparative insulating qualities of a great variety of materials, such as hair felt, pine needles, oak, gum and pine leaves, grass, Spanish moss, and dried sugar cane crushings—most of which could be found in the field and easily gathered for the rapid construction of a refrigerating box. The school's aim is to train men to meet the emergencies which are certain to arise in a hard campaign. Much of the equipment used in the school is improvised. One contrivance, the pride and joy of everyone from Captain Johannesen on down, is a nondescript compressor, made entirely from odds and ends. "Whenever we have an extra pressure gauge, or an old water tank, or a fly wheel we don't need," explains the Captain, "we just fasten it on."

Improvisation is a great stimulant of ingenuity and resourcefulness, the "carry on" spirit which makes an army continue to operate even when equipment breaks down and plans go wrong. Besides, improvised equipment in a training school means more new equipment available for the men at the front. Trainees at Captain Johannesen's school have put together a model ice plant, various condensing units, compressors, large and small coolers, for the most part from scrap materials. Some day, behind the fighting lines, they may have to use odds and ends similarly to good effect.

REFRIGERATION VICTORY PROGRAM GETS UNDER WAY

FURTHER progress was made in the Refrigeration War Drive of the Victory Program at a meeting called by Director John K. Knighton for September 2 in the Hay-Adams House in Washington, D. C. Detailed plans were made for the various regional meetings to be held this month.

The Washington meeting followed an earlier conclave of executive committee members and invited guests held August 6 in the Palmer House, Chicago. At this meeting the name of the enterprise was changed to the Refrigeration War Drive of the Victory Program, since it was agreed that this was both more descriptive and dynamic.

To get the drive under way, regional meetings will be held in five cities during September. The first will be in New York September 14, Ned Murphy, local chairman; then in order will follow: Dayton, O., September 16, Paul Zimmerman, chairman; Chicago, September 18, Frank Smith, chairman; St. Louis, September 21, Art Schellenberg, chairman; and Los Angeles, September 25, C. F. Pratt, chairman.

Efforts will be made to secure interesting speakers for each of the regional meetings, and a brochure, now under preparation, stating the purpose and objectives of the Refrigeration War Drive, will be passed out. Certificates of merit, after the manner of the "E" awards among war production companies, will be presented to the associations, companies and individuals who participate.

The motive behind the Refrigeration War Drive is to prevent the gap between increased usage and decreased facilities from becoming distressingly great, and thus, perhaps, causing hindrance to the war effort. Those in the refrigeration industry are aware of this danger, but outside factors, particularly the Government and the public, do not have full realization of refrigeration's vital character. By putting into operation a clear-cut program of voluntary conservation of critical materials, it is hoped to impress upon the Government, particularly, that refrigeration is entitled to a high place on the list of essential industries.

Art Schellenberg, president of the Alco Valve Co., St. Louis, Mo., has accepted appointment to raise funds by voluntary subscription throughout the refrigeration industry. Every effort will be made to secure maximum results with minimum expenditure.

The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment to "The Question Box."

HIGH HEAD PRESSURE

QUESTION 502: I have a Frigidaire D4 that I have done everything possible to fix, as soon as you start it up it will run about one minute pulling down the back pressure from 20 lbs. to 10 lbs., then the compressor will stop like the discharge valve is closed. I can't find the possible cause, please help me if you will. I also have an old model Norge about 1933 that we have put a new compressor on. This job carried a check assembly which I have not changed. We have also had the float rebuilt. This job does very similar to the Frigidaire, except that it will pull down to 20 in. vacuum with 150 lbs. head pressure before the compressor stalls. Both of these jobs are short of gas because I can't get them to run long enough to get the gas in them, they won't even pump down what I have in them.

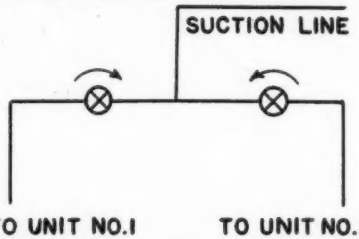
ANSWER: Both of these refrigerating units are charged ith SO2, and it might be that both of them are operating against too high a head pressure. You do not indicate the head pressure on the Frigidaire D4, but you have stated the back pressure is between 20 pounds and 10 pounds. I am inclined to believe your compressor has tight bearings or tight pistons. Carbon formation under the rings of the compressor or in the bearings will cause the compressor to tighten up and to stop after a few minutes running, and it is very likely your trouble is due to carbon.

Head Pressure Too High

You have stated that the Norge Compressor is operating under a 20" vacuum with a 150 pound head pressure when it stalls. 150 pounds head pressure is definitely too high for a sulphur dioxide system, this pressure should never exceed 70 to 80 pounds under normal conditions. Therefore, you must have either too much refrigerant in the system or air in the system which is creating such a high head pressure. I would suggest that you purge from the top of the compressor until the head pressure is brought down to normal.

MANIFOLD VALVES

QUESTION 503: An installation which I am inspecting has two 3 h.p. units of which only one operates at one time, the other acts as a stand by. There are manual operated valves on each machine so they close the valves on the machine which is not operating. I can best illustrate the valves as in the attached sketch. On the sides of these shut-off valves A and B are arrows which are supposed to be pointing with the flow of gas inside the pipe lines. Arrows on sides of A & B are shown as they are installed. Is this correct or should they be reversed? This



may not be of any consequence, but I would like to be sure as the contractor says they are O.K. This system uses Freon operating on 12# cut out and 35# cut in.

ANSWER: It is impossible that the gas would flow in two different directions in a suction line. Therefore, if these lines you have indicated in your letter are both suction lines, I would say that the arrows are pointing in the wrong direction. This, of course, is provided the arrows indicate the flow of gas.

I would be inclined to believe that the arrows indicate the direction that the valve is to be turned for the operation of unit No. 2. In other words, in accordance with your sketch and taking it for granted that the arrows indicate the direction of turning, it would show that valve A turned in the direction of the arrow would shut off unit No. 1 and valve B turned in the direction of the arrow would open unit No. 2, thus placing this unit in operation. The procedure would then put unit No. 1 in operation and shut unit No. 2 off.

LOCKER STORAGE ROOM

QUESTION 504: Have a locker storage room (no hardening room) outside dimensions 50 ft. long x 17 ft. wide x 10 ft. 5 in. high, insulated with 6 in. cork walls, ceiling and floor. There are 519 lockers, each with average load of 125 lbs. Products are placed in the lockers at a temperature of 0° F., and I want to keep the room at 0° F. which would mean a difference of about 85 degrees to 95 degrees F. at this time of year. Would you give me an estimate of the plate surface required, also the size of a water cooled condensing unit needed to maintain this temperature on 16 hour operation?

Along the 50 ft. wall is built the sharp freeze room, back of that is the storage room and chill room, these being hooked onto a different unit.

ANSWER: The calculations are based on the locker room dimensions of 50′ x 17′ x 10½′, 6″ of rock cork insulation, a room temperature of 0° and an ambient temperature of 95°. Since one of the 50′ walls is exposed to a 35° chill room temperature, you will divide the calculations in two groups.

The area exposed to 95° temperature difference is 2,581 square feet, and using as a factor 1.2 for the 6″ rock cork, the heat leakage will amount to 294,000 B.t.u. per 24 hours. The wall exposed to the chill room will have a leakage of 25,200 B.t.u. per 24 hours.

To the first figure we add a 20 per cent service load which is 58,600 B.t.u. and for the light load we add 27,400 B.t.u. Our total load is 405,200 B.t.u. per 24 hours.

If we figure the machine will operate 16 hours a day we will have to have a machine with a capacity of 25,400 B.t.u. operating —19° suction temperature. The "K" factor for plates is about 2 B.t.u. per square foot, and if we figure it operates on a 16° temperature difference we find that it will be necessary to have 792 square feet of plate surface. Both sides of the plate are figured in these calculations, therefore you will need 33 plates 12″ wide and 144″ long.

MAKING A FREEZER CHEST

QUESTION 505: I have a customer who would like me to build a small locker for him. I have the box which is 24 inches wide, 18 inches deep, and 30 inches high inside with 5 inches of insulation all around. I would like to use a cold plate for a coil. Temperature to be around zero. He would

like to have the coil placed in the center, so that when he does not have very much meat on hand an insulated shelf could be put in and one-half of the box would not have to be refrigerated.

Because it is impossible to buy a cold plate, I figured on using ½" tubing and bending it back and forth and then have a tinner put galvanized iron or tin on both sides and ends making it the same as McQuay Zero panels. Would frost form on the inside of this plate if the tinner made it air tight, or would there have to be a vacuum?

Because of the size of the box, my coil would be 18" x 24", and figuring 3½" bends, I could only get about 15' of ½" tubing into this coil. Would this be too little coil? If so, how much would I need? Would two coils of this size do the job, or should I forget about being able to put in the insulated shelf when he doesn't need the whole box, and mount a larger coil on the back side, when the coil could be 24" x 30"? It will be a Methyl Chloride job for meats in small packages. He will only go into the box about twice a week.

ANSWER: According to my estimate the heat leakage through the walls of this cabinet will be about 5,800 B.t.u. per 24 hours. This, however, does not represent the total load because it would be necessary to figure in the product load. You have not indicated how much meat would be placed in this cabinet at one time. Therefore, I have no means of determining the product load.

This load, however, will be 100 B.t.u. for every pound of meat frozen in the cabinet, and in order to determine the hourly load, it will be necessary to find out how quickly your customer wishes to freeze the meat, then divide the product load by the number of hours. In other words, if we suppose he placed 25 pounds of meat in the box at one time and wished to freeze this meat in a maximum of 10 hours' time, he would have to add $\frac{25 \times 100}{10}$ which is 250 B.t.u. per hour to the coil and condensing unit capacity.

On the basis of the heat leakage your machine and coil capacity will have to be 865 B.t.u. per hour if we suppose the machine is to operate 16 hours per day. If you are going to use ½" copper tubing without any plate soldered to it, you would require 60 feet of tubing to take care of this load. If we figure on cold plates as con-

structed by any one of the manufacturers, you would require 7 square feet of plate surface.

Both sides of the plate are figured in these calculations; therefore, your plate would have to be 3.5 square feet.

Inasmuch as the space you have for shelf equals 3 square feet, I believe it would be a good idea to use a shelf of 3 square feet and then place a second plate of about 2 square feet hanging vertically at the back of the box.

In constructing a coil of this nature, it would be possible to build it in the manner you have described. However, I think it will be necessary to obtain a closer bend than 3½" so that you can get more lineal feet of tubing into the plate. By using mechanical benders it should be possible to bend this tubing to 2½" bend. Furthermore, the tubing must be thoroughly bonded to both plates so that there will be good conductivity between the tubing and the plates on each side of it.

Another method of constructing this coil would be to construct a shelf using only one plate with tubing soldered to one side of it. This would give a flat surface as a shelf with tubing on the underside. Bare pipe coil could then be formed to fit along the sides and top of the cabinet. With this construction, however, it would be necessary to use more tubing because the square feet of surface for heat transfer would be reduced.

OIL CONGEALS

Question 506: What will cause oil to congeal in the coils of a low temperature Methyl Chloride System: Will an oil separator remedy this condition, or is there something that can be put in the system to keep the oil from congealing?

Answer: Two means of preventing oil from congealing in low temperature Methyl Chloride systems are, first of all, to select only the best wax free oils which have a pour point somewhat lower than the lowest temperature obtained in the coil. Many oils which may be suitable in higher temperature work will be totally unsuitable to low temperature work because there is a tendency to wax separation at the lower temperature and because the oil may tend to congeal at low temperatures or, in other words, will not flow as readily as necessary.

Of course, all oils will thicken at the lower temperatures and where it is possible, it is best to keep the oil out of the evaporator

entirely. For this reason it is always a good plan to install an oil separator in low temperature jobs which, if properly designed, will prevent all but a very small percentage of the oil from circulating with the refrigerant.

There is nothing you can put in these systems that would keep this oil from congealing. Your selection of the proper oil and the installation of a separator are the only two remedies.

* * *

R.S.E.S. Chapter Notes

KANSAS CITY CHAPTER

August 11—The meeting was called to order by President F. C. Smith at the home of E. L. Tramposh. Most of the meeting was devoted to a discussion on an educational program and a letter received from International Secretary H. T. McDermott concerning a future program. Mr. Cox announced that the next meeting would be held at his home, where the regular business session would be followed by a picnic supper furnished by the chapter.

SPRINGFIELD CHAPTER

June 25—A meeting was held in the offices of the United States Electric Company and called to order by President Farrelly, who introduced Mr. Eckhardt of the War Production Board. Mr. Eckhardt gave a very complete picture on the priorities situation as it affects the refrigeration service industry. Many questions were asked from the floor and very capably answered by Mr. Eckhardt. During the business session that followed, the group went on record as being in favor of cancelling the state picnic. Leonard Roos won the door prize for the evening.

July 19—The chapter's annual picnic was held at Lake Springfield on Sunday, July 19th, with about 45 persons in attendance. A most enjoyable day was had by all and, among others, Archie Fait found that overeating was not conducive to good ball playing. The horse shoe pitching contest was the final event of the day, with Champion Gene Kresse winning the crown. Jimmie Kline amused the youngsters with an exhibition of how to hit flies and grounders. John Stoppelwerth was the ladies' man of the day, keeping them excited by calling winners at the bingo game. F. W. Nichols and Mrs. Nichols deserve a great deal of credit for the fine work they did in staging

the affair. Needless to say, the youngsters were filled to the brim with soda pop, ice cream and other refreshments.

MOTOR CITY CHAPTER

July 14—The meeting was devoted to the annual election of officers and, after conducting the election in the usual way, the results were as follows: *President,* Einer Hansen; *Vice-President,* David Fortune; *Secretary,* Chester Morgan; *Treasurer,* Clare Babcock; *Sergeant-at-Arms,* O. O. Dobbs.

MILE HIGH CHAPTER

August 10—Probably due to the rush of work at this time of the year the attendance at the meeting was rather poor. Nothing special was planned and therefore the meeting was thrown open to general discussion and, as is usual during these war times, the discussion rapidly got around to the question of priorities and order P-126. During the discussion it was noted that several members had not yet received their license to operate as an emergency service agency. The meeting was adjourned at 10:30, after which refreshments were served by Ernest Martin and J. M. Richey.

TRI-COUNTY CHAPTER

June 19—The meeting was held at the Woodruff Hotel, with Vice President N. H. Rust presiding. The attendance prize was won by Robert L. Tyler, who was absent. A discussion of the state picnic resulted in a general opinion that it would be too far for the average member to travel by car this year and would require too much lost time to attend a picnic, and since it would be impossible for the Chicago Chapter to charter a bus as originally planned, it was felt advisable to cancel the state picnic. It was suggested that if the state picnic was cancelled, it may be possible for the Chicago, Rockford and Tri-County Chapters to hold a picnic in some central location which would, in some measure, offset the loss of the state picnic.

On the educational program, Mr. Vernon of the Johnson Service Company presented slides of the uses of pneumatic controls. He also gave some interesting notes on WPB's recent action in granting permission to install air conditioning in large war plants, giving as its reason that air conditioning a necessity and not a luxury.

July 24—The attendance prize was drawn by Fred Johanneson, who was absent. Considerable time was spent in a discussion of

a local picnic and then, after the business for the evening was complete, the members viewed two reels of talking pictures, the first of which was entitled "The Bombing of Pearl Harbor" and the second, "Fighting Incendiary Bombs." The ladies were guests of the chapter during the showing of these pictures.

Ladies Auxiliary

ILLINOIS VALLEY AUXILIARY

July 10—The meeting was held at the Jefferson Hotel, with a very good attendance. It was conducted by President Mrs. Dresback, and Mrs. Loercher was the hostess for the evening. Hearts were played, with Mesdames Fait, Sackey and Shinneman winning the prizes. Refreshments were served at the Tropics Room after the meeting.

August 1st—With no business on hand for the evening, the time was devoted entirely to entertainment, with Mesdames Fait, Loercher and Dresback winning the prizes of defense stamps.

MOTOR CITY AUXILIARY

The auxiliary has discontinued its regular meetings for the summer period; however, social meetings are being continued, one of which was held in June, and in July a picnic was held, at which both men and ladies participated. A wiener roast was planned for August 15th. Discussions have already started for the continuation of business meetings in the Fall. Plans are being mapped at the present time, and some project will be decided upon as an entertaining feature during the winter months.

MIDWEST JOBBERS TO MEET

THE Midwest Refrigeration Supply Jobbers will hold a meeting in Des Moines, Iowa, on Monday, September 28, this being one of the regular meetings held throughout the year. The manufacturers' men are invited to attend same.

A NEW INVENTORY EXCHANGE ORGANIZED IN DETROIT

THE War Emergency Materials Exchange has recently been organized in Detroit, Michigan, to be of service to the refrigeration industry—to help eliminate the critical mal-distribution of inventories hampering the war effort of this industry and to expedite the exchange distribution of products in the hands of refrigeration

manufacturers and wholesalers. The operation of the Exchange in no way alters the distribution of refrigeration products to the retail trade through regular trade channels. By uncovering dormant stocks it facilitates movement of these stocks into retailers' hands. Its purpose is to be helpful to the manufacturer, wholesaler, dealer or contractor, and service man.

William D. Keefe, president of the Exchange, has devoted his lifetime to the manufacture and distribution of refrigeration products. He is devoting his entire time and experience to the War Emergency Materials Exchange. J. M. Oberc, vice-president, well known in the refrigeration industry, has a long and successful record in the field of inventory control gained during twenty years' experience in the manufacture and distribution of refrigeration products. He is thoroughly familiar with all types of refrigeration equipment,—their makes, their models, their application. He knows what is needed, where it is needed, and how it must meet installation requirements. The new organization has already been most helpful to many in the industry.

DR. ROCKOFF WITH W.P.B.

THE War Production Board in Washington announced the appointment of Doctor Joseph Rockoff, Chief Chemist of the Dayton Rubber Manufacturing Company, Dayton, Ohio, manufacturers of V-belts and other rubber and synthetic rubber products, to a technical committee for individual awards, composed of engineers and technicians, to select a list of workers in war plants to be honored by the Government for contributing valuable suggestions for increased production. Doctor Rockoff has been with the Day firm for 22 years.

One hundred of the best 5,000 suggestions submitted by workers to labor-management committees in their plants will be reviewed by the Board.

Doctor Rockoff is a member of the American Chemical Association and is widely known as a chemistry and compound consultant and for his rubber and synthetic rubber chemistry compounding and processing research. He is a graduate of the University of Cincinnati.

The committee is headed by Doctor J. L. Bray, Purdue University.

Workers whose suggestions are regarded as of exceptional merit will receive the "cer-

tificate of individual merit," while workers whose suggestions are rated outstanding will receive the "citation of individual merit."

DR. JOSEPH ROCKOFF

In addition to Doctors J. L. Bray and Joseph Rockoff the committee includes: Paul H. Stanley of the Pitcairn Autogyro Co., Willow Grove, Pa.; Whiting Williams, consultant in industrial relations; Charles B. Francis, Carnegie-Illinois Steel Corp., Pittsburgh; Henry C. Atkins, Jr., of the E. C. Atkins Co., Indianapolis, and William Plumer Hill, Bethlehem Steel Corp., Sparrows Point, Md.

* * *

KEROTEST RECEIVES MARITIME COMMISSION'S "M" PENNANT

AWARD of the U. S. Maritime Commission's "M" Pennant, Victory Fleet Flag and Labor Merit Insignia to the Kerotest Manufacturing Company—first plant in the Pittsburgh district to receive the honor—was revealed August 25 by Walter G. Swaney, General Manager of the company, following the receipt of telegraphed notification from Admiral H. L. Vickery, Commissioner of the U. S. Maritime Commission.

The Admiral's telegram stated that the award of the Commission to the company was made in recognition of outstanding

efficiency in production. Presentation was made Saturday, August 29th, at a ceremony held in a newly-completed building of the company, and the Maritime "M" Flag was presented by Mr. C. E. Walsh, Jr., Director of the Procurement Division. Admiral Vickery gave the principal address.

In an interview Mr. Swaney stated that, "We are very proud to be one of the first plants in the country so far to receive the Maritime 'M.' This recognition of our part in supplying valves and fittings for America's urgent shipbuilding program applies to all Kerotest workers—men who gave and are giving their level best to a vital job.

"We'll keep the Maritime Flag flying," Mr. Swaney declared, "and Kerotest men and managing staff will wear the Maritime Victory Insignia as a badge of honor that will be a constant reminder of our obligation to push production ever higher. Every man in this organization knows that he is fighting a Jap or a German worker across the seas—and believe me, we're fighting to win!"

The "M" presentation on Saturday, August 29, was broadcast by Station KDKA, from 2:30 to 3:00 P. M., master of ceremonies being Ford Bond, well-known announcer of the National Broadcasting Company.

x x x

PHILCO RECEIVES ARMY-NAVY "E" AWARD

WHILE the United States has just reason to be proud of what has been accomplished during the first nine months of the war, the fact remains that we have not yet been able to take the initiative, Brigadier General A. A. Farmer, Signal Corps, United States Army, said recently in presenting the joint Army-Navy Production Award "E" to Philco Corporation for high achievement in war production. A crowd of 7,000 Philco employees and their families were present at the ceremonies.

"The enemy has raised the ante and we are going to call him—and raise him—and raise him again. We've had enough Bataans and Corregidors. We are going to win some pots ourselves. We're going to drop more bombs on Tokyo and Berlin, and win more smashing victories like those at Midway Island and the Coral Sea, and you people here in the Philco Corporation plants are going to help us.

"The 'E' flag is placed on your flagpole by the Army and Navy of the United States of America, in recognition of the fact that you did a good job of producing radio communications equipment, batteries and fuzes for use in the planes and tanks and guns and ships of your country and her Allies; but remember that the war is not yet over. Remember that you are all soldiers on the production line of freedom, and that what you are doing for America is being done voluntarily and freely, without regimentation and without coersion," General Farmer said in addressing Philco employees and their families.

James T. Buckley, President of Philco Corporation, accepted the "E" flag in behalf of the Company. "I would like to take time to give a personal salute to every employee of Philco whose collective effort has made this occasion possible," Mr. Buckley said. "The ability and the spirit you have demonstrated in meeting the high standards and schedules required by the Army and Navy are very heartening to the Services, and as new standards and new schedules are required there is no doubt of your ability to meet the needs of our fighting forces, no matter how long the struggle."

Larry E. Gubb, Chairman of the Board of Directors of Philco Corporation, presided at the presentation ceremonies. "This is a highly technical war," Mr. Gubb said in his opening remarks. "And the men and women of the production lines can be considered partners of the men in the battle lines. Under today's conditions of war, it isn't enough that the men in uniform have the courage and the willingness to fight. If they are to have an equal chance against the enemy, they must be equipped equally well. And if American industry and American workers can furnish our fighting men with better equipment—and more of it—we will be able to save many thousands of lives of our soldiers and sailors—and bring the war to a victorious conclusion so much the quicker."

Colonel D. N. Hauseman, District Chief, Philadelphia Ordnance District, presented lapel insignia to representatives of both management and employees. Receiving the insignia were John Ballantyne, vice president in charge of operations of Philco, in behalf of management; and Michael J. Toohey, President, Radio and Television Workers Local 102, U. E. R. M. W. A.; David Neish, chairman of shop committee, Radio and Television Workers Local 102,

U. E. R. M. W. A.; George Simpson, president, Radio and Television Workers Local 101, U. E. R. M. W. A.; Harold R. Sharpe, financial secretary, Radio and Television Workers Local 101, U. E. R. M. W. A.; and Edward Finn, steward, I. B T. C. W. H., who represented Philco employees, all of whom will be awarded pins within a few days.

"There are few of us here today who do not have a brother, a husband, or some loved one in the armed forces of this country," Mr. Toohey said in speaking in behalf of all Philco employees to acknowledge receipt of the lapel insignia. "That alone brings the war mighty close to home. But, in addition, no one realizes any more than the working men and women of this great country that it is our job here on the production front to keep the lines going. We know only too well that it is our war, and we are going to fight it out on the production front to keep the lines going. This is the pledge we make today to the Army and Navy of this great nation of ours."

Philco is producing radio equipment for planes, tanks, and ships, shells and fuzes, and industrial storage batteries for the war effort.

Index to Advertisers

SILICA GEL

IS DEFEATING MOISTURE ON *Two Fronts!*

ON THE WAR FRONT

Guarding implements and materiel of war against corrosion, rust and mildew caused by moisture during shipment to far-flung battle lines—so that our fighting forces will not be delayed putting these weapons to effective use.

ON THE HOME FRONT

Guarding America's refrigerators against damage caused by moisture in the refrigerant—improving efficiency and adding years of life to existing equipment—a Conservation job that permits more raw material to flow into ships, planes, tanks and guns.

The Finest that Money Can Buy

BONNEY TOOLS

Abuse.... No. 1 Enemy of Sockets

ABUSE is the No. 1 enemy of all tools . . . not only sockets. By abuse we mean using them on jobs for which they were never intended . . . using an undersize tool on an oversize job. Sure! We realize that sometimes you've just got to use makeshifts . . . but don't make a regular practice of it.

Use your Bonney Sockets *only* with handles and attachments of the size drive they were designed for . . . ½" drive sockets with ½" drive attachments . . . ⅜" with ⅜" . . . ¾" with ¾", etc. Don't use a ½" drive handle with a ⅜" drive socket . . . ¾" drive handle with ½" drive socket, etc. You're overloading your sockets if you do and with a tough pull, you'll crack the socket wall.

Be sensible . . . don't force a socket over a "burred" nut. It will cut the socket wall . . . put an added strain on it . . . cause it to crack.

You'll lick the No. 1 enemy of sockets . . . *abuse* . . . if you follow this advice. And your sockets will last much longer if you do. That's especially important during these times when good tools are scarce and hard to replace.

Sure, we're in business to sell tools . . . in business to sell all we can make. But we want you to take the best possible care of *your* Bonney Tools so you won't be disappointed because of your inability to get all of them you want during the war period.

The facilities of the Bonney organization are today being devoted almost entirely to supplying Bonney Tools for the war effort . . . the same tools you have found to give such excellent service during peace times.

So . . . *be smart* . . . *be sensible* . . . take good care of *your* Bonney Sockets. It's money in *your* pocket.

BONNEY FORGE & TOOL WORKS, Allentown, Pa.

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